REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Claims 5, 14 and 18 are requested to be cancelled without prejudice or disclaimer.

Claims 1, 10, 20, 21 and 23 are currently being amended. Support for the amendment to claim 1 can be found at least in original claim 5. Claim 10 has been amended to be consistent with the amendment to claim 1. Claims 20-21 and 23 have been amended to change their dependency.

Claims 26-28 are being added. Support for new claim 26 can be found at least in the specification on page 16, lines 2-8. Support for new claim 27 can be found at least in the specification on page 16, lines 2-8, and in original claims 5 and 6. Support for new claim 28 can be found at least in Table 5 and the description thereof in the specification.

This amendment adds, changes and deletes claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending the claims as set forth above, claims 1, 3, 7-10, 15-17 and 20-28 are now pending in this application.

Rejections Under 35 U.S.C. § 103

Claims 1, 3, 5, 7-10, 14-18 and 20-23 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,693,203 to Ohhashi et al. (hereafter "Ohhashi") in view of applicants' alleged admission in the Rule 132 declaration filed on April 12, 2004. Claims 24-25 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ohhashi in view of acknowledged prior art on page 2, lines 1-24 (hereafter "the APA"). Applicants respectfully traverse these rejections for at least the following reasons.

Ohhashi neither discloses the structure, or a method of achieving the structure, as recited in the independent claims.

Independent claim 1 is directed to a high purity Nb sputtering target. Claim 1 recites an amount of Ta in a range of 550 to 3000 ppm, a Ta content dispersion within 30%, an amount of oxygen in a range of 10 to 200 ppm, and an oxygen content dispersion within 80%. Thus, claim 1 recites a dispersion of Ta and oxygen, as dispersion is specifically defined in claim 1, in addition to a concentration of Ta and oxygen. As noted throughout the prosecution of this application, the present inventors have realized that merely decreasing the Ta or oxygen content alone in a high purity Nb sputtering target does not decrease the resistivity of the entire Nb film formed by such a target with reproducibility. The inventors have found that, in high purity sputtering targets, the dispersion and content of Ta in the Nb target, and the dispersion and content of oxygen in the Nb target, are important parameters. This combination of recited Ta content and dispersion, or oxygen content and dispersion in a Nb sputtering target is not suggest by Ohhashi.

Ohhashi does not disclose a method for achieving the structure as claimed

As disclosed in the present application, the content and dispersion of Ta or oxygen as an inevitable impurity in a Nb sputtering target can be reduced by controlling the number of times of EB melting, applying a zone refining method, and by controlling a working ratio of plastic working (See specification on page 15, line 13 to page 16, line 13, for example). When the manufacturing conditions are not proper, the content and/or dispersion of Ta and oxygen in the raw material cannot be controlled within an effective range, and the resistivity of the interconnection formed by the sputtering target increases.

Further, as disclosed in the present application, the diameter range of crystal grains can be controlled by heat-treating after plastic working. Thus, by properly controlling the process, giant dust in a formed Nb film can be decreased. This process also decreases the dispersion of Ta and oxygen in a Nb sputtering target.

By contrast, Ohhashi neither discloses the recited content and dispersion of Ta and oxygen of claim 1, nor does Ohhashi suggest any manner of achieving the recited dispersion

and content levels. First, Ohhashi does not disclose anything regarding the peculiar effects caused by impurities such as Ta and oxygen in a Nb sputtering target used to form a Nb film. Further, Ohhashi does not disclose any concrete examples relating to a manufacturing method to achieve the recited levels in a Nb sputtering target. Moreover, with respect to the control of the range of Nb crystal grain diameter, Ohhashi does not disclose any heat treatment performed after a plastic working process, or any other process, to achieve the range. The Patent Office has failed to provide any evidence that Ohhashi discloses a Nb sputtering target with the recited combination of content and dispersion of oxygen or Ta, or the range of Nb crystal grain diameter in claim 1, or that the manufacturing methods of Ohhashi could obtain such levels.

"Dispersion" as defined in independent claim 1

As an initial matter, applicants would like to address the difference between the "dispersion" of an element, as dispersion is specifically defined in claim 1, and the distribution of that element in a sputtering target.

The Patent Office states on page 4 of the Office Action "[t]he claimed dispersion % includes zero when dispersion is uniform/constant that maximum value is same as minimum value." Applicants would like to clarify that while a uniform distribution of impurities would suggest a zero dispersion %, as dispersion % is defined in the claims, a uniform dispersion % merely means that the dispersion % is constant, not zero. That fact that a value of a parameter is constant does not suggest that the parameter is zero.

The claimed amount and dispersion is not disclosed in Ohhashi, nor is it inherent.

As noted throughout the prosecution of this application, Ohhashi does not suggest a Nb sputtering target with the combination of Ta amount and dispersion, or oxygen amount and dispersion as recited in claim 1. Ohhashi does not deal with the existence of Ta or oxygen in a Nb target, nor does Ohhashi recognize the problems caused thereby, much less the specific amounts and dispersion characteristics recited in claim 1. In the Ohhashi disclosure, Nb is merely enumerated as one of various metal materials for sputtering targets. Ohhashi does not disclose any specific examples relating to a Nb target, instead, Ohhashi discloses a high purity tungsten sputtering target (example 5) and a high purity titanium

sputtering target (example 6). Ohhashi, which merely provides specific examples of W or Ti sputtering targets, does not recognize the above problem in a Nb sputtering target, and does not suggest any specific amounts or dispersion of Ta or oxygen in a Nb sputtering target.

While Ohhashi discloses a uniform microstructure for the grains of his sputtering target with little diffusion for the atoms of the grains, such a uniform grain microstructure does not suggest what the amount or dispersion may be for inevitable impurities such as Ta or oxygen in a Nb sputtering target. The Patent Office states on page 5 of the Office Action that "uniform microstructure as taught by Ohhashi does not exclude uniform dispersion." While uniform microstructure may not exclude uniform dispersion, it also does not imply the dispersion levels as recited in claim 1. Moreover, a uniform dispersion, as dispersion is defined in the claims, merely means that the dispersion is constant, not that the dispersion is zero as suggested in the Office Action.

As noted throughout the prosecution of this application, the combination of Ta amount and dispersion, or oxygen amount and dispersion as recited in claim 1 is not inherent in Ohhashi. Moreover, the Patent Office has not met its burden of showing that the amount and dispersion levels of the inevitable impurities Ta and oxygen recited in claim 1 are necessarily present in the Nb sputtering target disclosed in Ohhashi. To the contrary, applicants have shown that the Ta and oxygen amounts and dispersion recited in claim 1 is not inherent in Nb sputtering targets. Applicants provide, as evidence that proves lack of inherency, examples from the present specification which disclose some Nb sputtering targets having Ta and oxygen with amounts and dispersion outside the range recited in claim 1.

The Patent Office states on page 4 of the Office Action: "[t]here is no factual evidence that the claimed range of Ta and O impurites are critical and not inherent in commercial Nb," (emphasis in original) and on page 5 "the claimed Ta concentration is merely conventional concentration in crude niobium metal." First, as noted above, the burden is on the Patent Office to establish inherency, and the Patent Office has not done so in this case. Further, as noted above, applicants have shown that the Ta and oxygen amounts and dispersion recited in claim 1 are not inherent in Nb sputtering targets through examples in the specification. As

noted throughout the prosecution of this application, the Patent Office has provided no evidence that the distribution of the inevitable impurities Ta and oxygen in a Nb sputtering target would be uniform, such that the dispersion % of these impurities are zero. To the contrary, the many examples of non-zero dispersion % in the present specification clearly suggests that a zero dispersion % of oxygen and Ta in Nb sputtering targets is not inherent. Merely because an element is an impurity does not suggest that it has a uniform distribution. If the PTO maintains this contention, applicants again respectfully request the PTO to provide evidence supporting its contention.

The claimed amounts and dispersion are not obvious in view of Ohhashi

As noted throughout the prosecution of this application, the Ta and oxygen amounts and dispersion recited in claim 1 is not obvious in view of Ohhashi, in view of the fact that Ohhashi does not suggest that the Ta and oxygen amounts and dispersion are result effective variables for his Nb sputtering target. A particular parameter must first be recognized as a result-effective variable in order to show that a claimed range would have been obvious. See MPEP 2144.05 II B. In the present case, Ohhashi does not even recognize the existence of inevitable Ta or oxygen impurities in a Nb sputtering target, much less that such parameters are result effective variables. Thus, the recited Ta and oxygen amounts and dispersion in claim 1 is not obvious over Ohhashi for at least this reason.

The Patent Office on page 5 of the Office Action states:

> Changing form, purity, or other characteristic of an old product does not render the novel form patentable where the difference in form, purity or characteristic was inherent in or rendered obvious by the prior art. In re Cofer, 354 F2d 664, 148 USPQ 268 (CCPA 1966).

In the present case, however, the Patent Office has neither provided any evidence that the recited Ta and oxygen amounts and dispersion are inherent, nor that they are obvious. To the contrary, Ohhashi does not even recognize the existence of inevitable Ta or oxygen impurities in a Nb sputtering target, and thus the claimed range would not have been obvious.

Ohhashi does not suggest the unexpected advantages resulting from the claimed amounts and dispersion

As noted throughout the prosecution of this application, claim 1 is further seen to be patentable over Ohhashi in view of the advantages of the invention as claimed. Ohhashi fails to suggest these advantages, or to even recognize the parameters that are important in attaining these advantages. The inventors have determined important parameters in solving resistivity problems of Nb liner films for Al films. The present inventors have realized that merely decreasing the Ta or oxygen content alone does not decrease the resistivity of the entire Nb film with reproducibility. The inventors have found that, in high purity sputtering targets, the dispersion and content of Ta in the Nb target, and the dispersion and content of oxygen in the Nb target, are important parameters. These parameters are implemented in the sputtering targets of independent claim 1 which recites the content and dispersion of Ta and the content and dispersion of oxygen which provide an improved Nb sputtering target. By suppressing the dispersion of Ta or oxygen in the Nb target, while at the same time decreasing the content of Ta or oxygen in the Nb target, it becomes possible to decrease the resistivity of the entire Nb wiring film, such as a film formed as a liner for an Al wiring film, when that film is formed using the sputtering target.

The Patent Office states on page 6 of the Office Action:

> As is shown by JP 62-103335 that Ta and O are controlled to be less than 30 ppm and 10 ppm respectively in ultra high purity Nb which are much lower than the instant claimed Ta less than 3000 ppm and O less than 200 ppm (claims 1 and 18).

As noted above, however, the present inventors have realized that, in high purity sputtering targets, the dispersion in addition to the content of Ta in the Nb target, and the dispersion in addition to content of oxygen in the Nb target, are important parameters, not just the content alone. It is this combination of dispersion and content, not just content

alone, which is claimed in claim 1, and neither JP 62-103335 nor Ohhashi disclose the dispersion levels recited in claim 1.

The Patent Office states on page 6: "the claimed dispersion (%) has not criticality or unexpected result." Applicants respectfully disagree. The beneficial effect of suppressing the dispersion of Ta or oxygen in the target to within the levels recited in claim 1 is demonstrated in the present specification, as noted throughout the prosecution of this application. Ohhashi completely fails to recognize or teach this key relationship that is the basis for the present invention directed to a Nb sputtering target, and consequently the reference does not and cannot render the present invention "obvious".

The alleged APA also fails to suggest the parameters as recited in claim 1, and thus fails to cure the deficiencies of Ohhashi. For at least the reasons given above, applicants respectfully submit that claim 1 is patentable over Ohhashi and the APA. Independent claim 24 includes a similar Ta parameter limitation to claim 1, and is thus patentable for at least this reason. Independent claim 25 includes a similar oxygen parameter limitation to claim 1, and is thus patentable for at least this reason.

Independent claim 1 also recites features regarding average grain diameter, and diameter range. Nowhere does Ohhashi disclose the average grain diameter, or diameter range, as recited in claim 1. Ohhashi also fails to teach or suggest suppressing the occurrence of giant dust particles by controlling these features. Ohhashi does not recognize that the average grain size is important in reducing dust, nor does Ohhashi disclose the specific average grain size recited in claim 1. Ohhashi merely discloses a crystal grain size of no more than 350 μm.

New independent claim 27 recites the same Nb grain size parameters as claim 1, and is patentable for at least this reason. Moreover, new claim 27 recites "wherein the high purity Nb target has a recrystallized structure formed by heat-treating a high purity Nb plate at a temperature in a range of 800 to 1300 C for one hour or more." Ohhashi, fails to disclose either the process of heat-treating a high purity Nb plate at a temperature in a range of 800 to

1300 C for one hour or more, or the structure resulting therefrom as recited in claim 27. As discussed above, the range of diameter of crystal grains can be controlled by heat-treating after plastic working. Ohhashi does not recognize this feature of claim 27, and fails to anticipate that claim.

Applicants have generally addressed the Patent Office's numerous comments from the Office Action above. Applicants failure to address any specific comment should not be taken as acquiescence to propriety of the comment, and applicants reserve the right to further address the comments in the future.

The dependent claims are patentable for at least the same reasons as their respective independent claims, as well as for further patentable features recited therein.

Applicants believe that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorize payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date Febuy 15, 2008 By _____

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